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RESEARCH PAPER

Exploring the Socio-Economic Situation of Plantation Villagers: A Case Study in Myanmar Bago Yoma

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Abstract Since the early 1980s, Myanmar Forest Department has been recruiting shifting cultivators, establishing plantation villages and applying the taungya method in establishing teak plantations. From the beginning, there has been an argument about whether the program is creating 'forest protective groups' or 'forest destructive groups'. A key determinant to that question from the research viewpoint is the socio-economic situation; knowing the present situation of the plantation villagers can help to understand their forest management practices. Interview surveys were carried out in three villages in Bago Yoma, the main region of the special teak plantation program, to examine the current economic benefits to plantation villagers. Questions were designed mainly to explore the incentives for people participation and the socio-economic situations of the plantation villagers. Principal component analysis was used to group landholder types. It was found that local people are willing to participate in the initial establishment of plantations. However, all the incentives relating to plantation projects are temporary, with no long-term consideration for taungya farmers, which jeopardizes the plan to create forest protective groups. It is concluded that the time has come for the Myanmar Forest Department to change its main aim of earning foreign exchange from establishment of teak plantations through the taungya method to redressing deforestation through people participation based on rural socio-economic development.

Keywords Shifting cultivators · Taungya teak plantation · People participation · Principal components analysis

This paper is based on the M.Sc. dissertation of Maung (2007), An earlier version of the paper was presented at the IUFRO Group 3.08.00 conference in Ormoc City, Leyte, Philippines, in June 2007.

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Introduction

Massive scale reforestation has been undertaken in Myanmar as a drastic measure to fulfil the increasing demand for timber and to prevent the conversion of deteriorated forestland to agricultural land, with more than 30,000 ha of forest plantations being established annually since 1984 (Myanmar Forest Department 2000a). Myanmar also launched a Special Teak Plantation Program in 1998, which has an annual plantation target of 8,000 ha in addition to the normal plantation scheme. Shifting cultivators are being recruited and the taungya method in plantation projects (San 1999; Ba 2001) is being adopted because it can avoid conflicts at the time of teak plantation establishment, achieve large plantation area targets in remote areas and overcome the problems of insufficient funding and insufficient labour. Because the plantation area is under the intensive care of taungya farmers for their intercrops, the Forest Department can expect a high survival rate of newly planted trees. The Forest Department is planning a joint venture by establishing plantation villages near or inside the reserved forests with the aim of securing labour for plantation establishment at reduced cost and with increased efficiency, as well as protecting the existing natural resources including old plantations more intensively with the participation of the taungya farmers. In brief, Myanmar Forest Department is trying to get people participation in the promotion of reforestation.

From the commencement of the project, the foresters have been arguing about whether the project would create 'forest protective groups' or 'forest destructive groups'. Past experience suggest that taungya farmers are likely to destroy the plantations once they have been established. 'Evidently there were destructions of many teak plantations and other plantations of valuable species during the Second World War (1942–1945) and again during the 1988 pro-democracy movement by the villagers who had involved in establishment of those plantations' (Ba 2001). It would appear that the cause of forest destruction is an economic one, hence it is essential to explore the socio-economic situations of the groups involved in taungya teak plantations. Admittedly, these cases occurred at times of breakdown in social order, but they were associated with poverty.

The problems facing Myanmar are not dissimilar to those experienced in other countries where forest destruction has been a major problem in recent years. As noted by Mitchell (1997), 'sustainability requires public participation at a level that ensures that social values and needs are incorporated as key considerations'. Davies and Wismer (2007, p. 10) observed in relation to Hainan's Li minority in China that '[S]ustainable development … will be impossible without sustainable forestry. Sustainable forest management that takes into account social, environmental and … economic considerations must form an important part of the government's overall … plans'.

To understand the socio-economic issues involved, some form of clustering of household groups is needed. Some studies have combined factor analyses with cluster analyses to produce typologies. In general, the typologies that have been developed for forestry studies have been factor and cluster analysis of people's forest management objectives—e.g. Wiersum et al. (2005), Toivonen et al. (2005)—while the studies that have used factor and cluster analysis to examine

development more generally have used analysis of the livelihood assets of households to determine their current situation and possible development pathways—e.g. Pender (2002), Jansen et al. (2006). Both these references refer to livelihood analysis techniques developed by the Overseas Development Institute, as described by Scoones (1998).

Objectives of the Study

The specific objectives of the study reported here have been: (1) to assess the institutional choice of plantation village establishment, (2) to examine the current economic benefit of plantation villagers as a key determinant to encourage their participation, and (3) to identify measures that should be culturally and socially suitable for plantation villagers and achieve the objectives of the Forest Department. To fulfil the objectives in a comprehensive manner, the following hypotheses were developed.

Hypothesis 1: Establishment of temporary plantation villages may have difficulties in accommodating social welfare systems.

Hypothesis 2: Establishment of permanent plantation villages without a long-term economic development program may lead to system failure.

Hypothesis 3: Establishment of plantation villages just to escape a current crisis will lead to system failure.

People Participation in Redressing Deforestation

The Township Forest Departments[1] have been facing problems of shortage of labour, limited budget to accomplish large areas of planting, and conflict in handling agricultural encroachment in planned target areas. There is a need for incentives to encourage people to participate in the special teak plantation program, which commenced in 1998. In the case of plantation establishment, strong incentives for gaining participation in successful reforestation would be shelter, the right to taungya cultivation, the opportunity for informal employment, and access to education and healthcare. In contrast, absence of these benefits would mean little incentive for participation.

If a group decides to participate in a teak plantation project, they will first be given the right to build a temporary settlement near the plantation. Taungya farmers have the right to decide how many hectares their family would like to take for the planting season and have the right to choose agricultural crops provided these do not interfere with the teak plantation. All of these are formal incentives designed to gain the participation of the people in teak plantation projects. Local foresters also judge between need and greed, and grant some informal rights relating to forest resource use.

[1] The performance of the Township Forest Departments varies according to the will and motivation of Township Forest Officers, e.g. some build schools for the plantation villages, and some do not.

Ba (2001) claimed that local people and even taungya farmers did not welcome plantation projects. However, according to interviews carried out in three plantation villages during 2004, taungya farmers do not oppose plantation projects, and even participate in the establishment of plantations, at least in the initial stage. They know they can gain formal rights to cultivate taungya and receive wages from their participation. Lack of participation simply arises due to the absence of a long-term development program.

Taungya Teak Plantations and the Plantation Villages

Taungya is a Myanmar word meaning *upland fields* or *upland farming*. Taungya teak planting is defined here as the growing of teak seedlings together with taungya. Land in the reserved forests in Myanmar falls under the management of the Forest Department, which would prefer to establish teak plantations. The forest occupants and the landless poor would like to cultivate taungya in the reserved forests. The establishment of taungya teak plantations provides a win-win situation for both sides.

According to widely accepted opinion (e.g. Blanford 1958; Chein Hoe 1969; Nair 1993), raising teak by the taungya method was first attempted in 1856 at Tharyawady in the Bago Division. The Forest Department (2000b) reported that the first taungya teak plantation in Myanmar was established in 1856 by Pan Hee, a Karen farmer, as a personal present to Dr. Brandis, the Governor.[2]

The first attempt to establish a forest village in Myanmar occurred during the period 1918–1947 after the Forest Department had decided to introduce a uniform system using a concentrated taungya regeneration method. Unfortunately, the plan did not go well due to the 1930 Thayarwady farmers' revolt, economic depression and the extensive attacks of bee-hole borer (*Xyleutes ceramica*) in teak plantations of Burma and Thailand, which led to the termination of the taungya teak plantations. Most of the taungya farmers went back to their traditional shifting cultivation.

In 1983, the second attempt at reforestation took place with the East Pegu Yoma Project (EPP), using the taungya system and the coexisting plantation village. In those days taungya farmers had relatively high incomes, so even lowland farmers from the central plains joined the project. However, at the end of the project, the primary aims of the Forest Department for reforestation and forest protection were not achieved due to the lack of a program that would provide long-term incentives to the villagers. Most of these village areas were transformed into *grey zones* of forest administration[3] and were later classified as forest destructive groups because villagers tried to carry out shifting cultivation in teak plantation areas.

Since 1998, the Myanmar Forest Department has been involved in a third attempt to establish plantation villages in an effort to avert the possibility of not

[2] Dr. Brandis was a German botanist-turned-forester, who was hired by the British in 1856 to oversee the administration and management of the vast and complex Bago Yoma Region.

[3] A grey zone of forest administration signifies an administrative dilemma, where the border between protective and destructive behaviour is unclear.

accomplishing goals established by the special teak plantation project. Most of the abovementioned groups have joined the teak plantation establishment as experienced workers. The process of reforestation using taungya methods and establishment of plantation villages is taking place again.

The Study Area

The study area is the Bago Yoma Region (Fig. 1), where taungya teak plantations and a plantation village system are being implementing under the Special Teak Plantation Program. Bago Yoma region contains 31 townships from eight districts, divided into four divisions (Bago East, Bago West, part of Yangon and part of Mandalay), with a total area of 1.96 M ha. Each township has a Township Forest Department.

Vast and complex tropical forests exist in Bago Yoma region, which was once famous as the home of teak (*Tectona grandis*). Associated with teak are pyinkado (*Xylia dolabriformis*), padauk (*Pterocarpus macrocarpus*), yon (*Anogeissus acuminata*), thadi (*Protium serratum*), hnaw (*Adina cordifolia*) and htauk-kyant

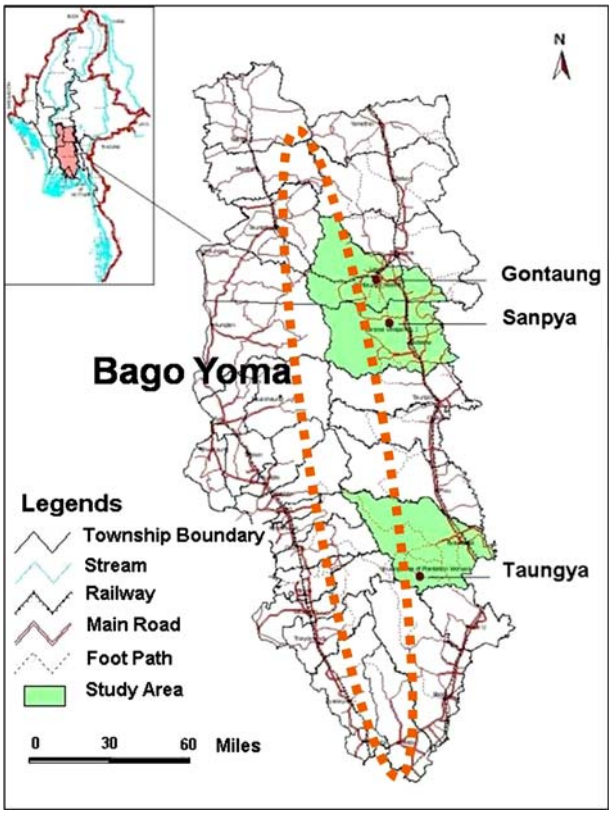

Fig. 1 Location of the study area. *Note*: The dotted circle represents the mountainous area, the actual Bago Yoma. Yoma means mountain ranges in Myanmar

(*Terminalia crenulata*). The characteristic bamboo species are kyathaung-wa (*Bambusa polymorpha*) and tin-wa (*Cephalostachyum pergracile*).

In recent years, with improved access to remote forested areas, these forests have rapidly degraded due to over-exploitation of wood and other forest products for domestic use by the increasing population, and agricultural expansion. Although plantation forestry cannot replace all functions of natural forests, it is one option for redressing deforestation. A large-scale teak plantation project known as the East Bago Yoma Project was carried out from April 1979 to March 1985. There is also a continuing Bago Yoma Greening Project, which commenced in April 2004.

Research Method and Data Sources

In order to select suitable townships, three common elements were identified, namely the existence of currently established special teak plantation programs, the existence of areas affected by shifting cultivation, and the existence of rural indigenous groups near teak plantations. After interviewing the staff of the Forest Department who are familiar with the local area, 12 townships were found to satisfy the desired criteria.[4] However, due to time and financial constraints the researcher selected two permanent plantation villages (Gontaung and Sanpya), and one temporary plantation village (Taungya) on the eastern slope of the Bago mountain ranges, as case study areas for a household survey.

The research was based on the exploratory social survey method. Because the demographic data of the villages were unknown prior to the survey, it was planned to interview 100 households using quota sampling. However, due to the field situations of the study sites,[5] only 90 households were selected using judgment sampling (Table 1).

The questionnaire addressed four main areas, namely general information about the households, socio-economic situations of the households, relation to taungya teak plantation, and relation to community forestry plantation. Questions were designed to explore the incentives for people participation and the socio-economic situations of the plantation villagers. Face-to-face interviews were conducted using structured questions, quantitative in nature, for easy communication with local people. All the family members were welcome at interviews, which were conducted in the form of conversations to avoid unease.

Principal components analysis (PCA) was applied to the survey data to explore the inter-relationship among a set of socio-economic variables in order to test the above hypotheses. The approach taken in this study parallels that of Pender (2002) and Jansen et al. 2006), but using PCA rather than cluster analysis. Although cluster analysis would possibly provide more easily interpreted results, PCA has been

[4] A 'township' in Myanmar consists of one town and several villages.

[5] At Gontaung, systematic sampling was used to select 25 houses. Sanpya had only 20 households, which was less than the planned quota of 25, and all the 20 households were included in the sample. Residents of Taungya village were in the process of moving from an old plantation site to the present site at the time of the survey. The scattered uphill locations of Karin dwellings created logistical difficulties, and a decision was made to exclude those households which had not yet arrived at the new plantation site.

Table 1 Planned quota and actual numbers of households selected in the study area

Township	Surveyed village	Ethnic group	Planned quota	Actual number of households
Lewe	Gontaung	Bamar	25	24
Yedashe	Sanpya	Bamar	25	20
Kyauktaga	Taungya	Bamar	25	28
Kyauktaga	Taungya	Karin	25	18

chosen because it is useful for condensing a large number of variables in a data set and for obtaining one, two or three-dimensional views of a multi-dimensional data set so as to identify the underlying structure. Principal components analysis provides a summary of several characteristics based on a particular quality and allows the user to make an abstraction from the common characteristics of the variables. With this feature, the PCA is capable of revealing, observing and defining the common and fundamental meaning or information essence covered by several data sets with differing dimensions (Ozaslan et al. 2006).

System Functioning and the Socio-Economic Situation of the Plantation Villagers

The main source of income for households in the case study villages is casual employment in the teak plantations. Taungya farmers are paid by the Forest Department after finishing their tasks in allocated areas. Alternative sources of income include cash crops and livestock raising. There is also income from forest resource extraction. People who had suffered from sickness or crop loss, or who had insufficient rice, were found to be more likely to engage in what local people call 'doing extra jobs' which includes bamboo cutting, charcoal making and collecting leaves. Most taungya farmers see the extraction of forest products as a means to overcome economic hardship.

Some household income statistics are reported in Table 2, where income by source is divided into three frequency classes (low, moderate and high), with cutoff levels of 50,000 Kyats[6]/year and 100,000 Kyats/year. About 45.5% of the sample households reported relatively low incomes from casual plantation work. Two thirds of households received moderate or high incomes from taungya cash crops. Low levels of income from cash crops occur among those who no longer have a taungya area for cultivation or as a result of crop loss caused by too little or too much rain. Only eight out of 90 households are reliant on livestock breeding and 5 are reliant on forest resource extraction. Most of the households fall in the low-income bracket of livestock raising, and hence face a need for encroachment to generate income and grow food. However, it should be noted that the higher-level income from livestock raising may be the result of selling domestic animals used for farming due to economic hardship. Similarly, income from forest resource extraction has a strong relation with economic hardship. The more severe the economic hardship, the more

[6] US$1 = 1280 Myanmar Kyats, as in April 2007.

Table 2 Income level and sources of income for households in the study villages

Source of income	Low (<50,000 Kyats/year)		Moderate (50,000–100,000 Kyats/year)		High (>100,000 Kyats/year)	
	Number of households	%	Number of households	%	Number of households	%
Casual plantation work	41	45.5	24	26.7	25	27.8
Cash crops	30	33.3	20	22.2	40	44.5
Livestock breeding	79	87.8	3	3.3	8	8.9
Forest resource extraction	78	86.7	7	7.8	5	5.5

taungya farmers engage in forest resource extraction which might lead to illegal extraction of forest produce. Thus, the Forest Department needs to recognize the necessity for continuing sources of household income other than forest encroachment.

The most common human diseases are malaria and tuberculosis, with influenza and tonsillitis prevalent in the rainy season, and with some cases of diarrhoea. Most of the villagers have difficulty accessing hospitals. Even though health care services exist in normal administration villages, medical services in the plantation villages are limited to midwives appointed by the Township Forest Department. In the case of serious diseases, the villagers have to go to the hospital in the nearest town.

Primary schools have been established in permanent plantation villages. However, it is difficult to arrange schools for the children in temporary villages, and the children's education depends solely on temporarily hired teachers. The appointment of temporary teachers is the responsibility of the local Forest Department and thus depends on the will and motivation of the local forest officials.

Legal Rights for Plantation Villagers

The plantation villagers are granted the formal right to cultivate intercrops in teak plantation areas. Depending on the ability of the family to work, the size of the taungya varies from 1 to 6 ha. Intercropping is possible for at least 2–3 years after planting teak. However, most of the villagers intercrop only for one year, because the nutrients enriched through the slash-and-burn are lost through leaching and erosion, and they have to migrate as the plantation project moves on to new areas. The villagers have the right to choose the agricultural crops they would like to grow as intercrops, as long as cropping does not interfere with the planted teak. In addition, they receive payments for participating in teak plantation work. Local Forest Departments sometimes give plantation villagers access to about 0.4 ha per household of *wetland*[7] areas to cultivate rice for household consumption.

[7] Since it is impossible to grow teak in wetland areas, which are flooded with water for most of the rainy season, the Forest Department allows taungya farmers to cultivate paddy fields. Taungya farmers transform these areas into rainfed paddy fields.

Community forestry plantations introduced by forestry officials can be seen in some permanent villages, although only at a small scale and only among the most trusted groups. The duration of land lease for the establishment of a community forest is initially set at 30 years, and after this period extension of the lease depends on the performance and desire of the users group.

The Socio-Economic Situation of Plantation Villagers

Gontaung Plantation Village (hereafter Gontaung) emerged through one of these resettlement programs for agricultural encroachers in 1998. In that year, Lewe Township Forest Department planned to establish a special teak plantation of nearly 405 ha. However, the planned teak plantation area had already been encroached by the nearby villagers. Some farmers, agricultural labourers and their families even lived inside the reserved forest. Although it took back all the farmlands to establish the teak plantation, Lewe Township Forest Department allowed the villagers to continue cultivating about 96 ha of traditionally owned rice fields.

According to the data obtained from the village head, the population of Gontaung is 280, comprising of 56 households with an average household size of five. The major ethnic population is Bamar. The village resource map of Gontaung is presented as Fig. 2.

The villagers plant coconut palm (*Cocos nucifera*), bananas (*Musa* spp.), mango trees (*Mangifera indica*) and vegetables in their home gardens. A major problem is lack of land for cultivation and lack of income opportunities from plantation work. They make their living by working as agricultural labourers or by illegal logging and charcoal making, which both pose a threat to the sustainability of teak plantations. Agricultural encroachment is also taking place in the plantation area.

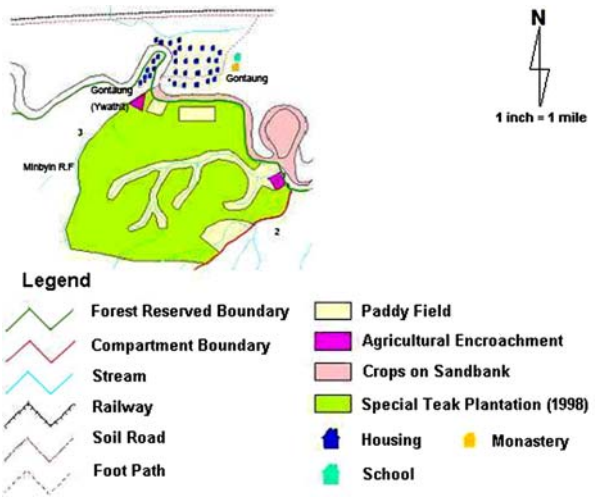

Fig. 2 Village resource map of Gontaung Plantation Village

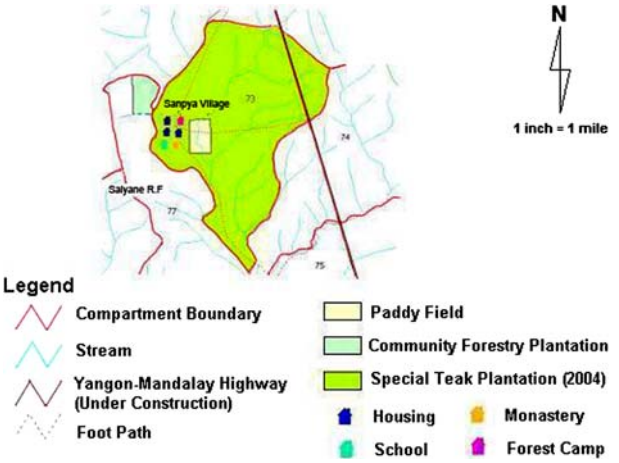

Fig. 3 Village resource map of Sanpya Plantation Village

Sanpya Plantation Village (hereafter Sanpya) was formed in 2004 through the strong will and participation of both the Yedashe Forest Department officials and taungya farmers who had a long history of involvement in taungya teak plantations. According to the village head, the population is 88, with 20 households. As in Gontaung, there is only one major ethnic population group, the Bamar. All the families are actively participating in taungya teak plantation establishment. The village resource map of Sanpya (Fig. 3) indicates the taungya teak plantation established in 2004.

The size of the taungya varies from 2 to 8 ha per household. Besides taungya intercropping, the Forest Department granted rights to cultivate rice fields of 0.32 ha per household inside the reserved forest. The villagers also have a certificate to establish a community forest of 8 ha on reserved forestland. The Forest Department have also encouraged every household to establish home gardens, consisting of edible fruit trees including coconut palm (*Cocos nucifera*), bananas (*Musa spp.*), mangoes (*Mangifera indica*), guava (*Psidium guajava*) and vegetables, by providing the seeds and seedlings at no cost.

The taungya farmers in Taungya Plantation Village (hereafter Taungya Village) are experienced in moving around the reserved forests and have been working in taungya teak plantations within the Kyauktaga township for more than 20 years. For some villagers, the custom of participation in taungya teak plantation establishment dates back to their parent's time. The total population is 796, made up of 173 households. The ethnic composition is Bamar (62%) and Karin (38%).

All the households are participating in taungya teak plantation establishment. Depending on their capability, the size of the taungya varies from 1.6 to 4.8 ha per household. Types of intercrops cultivated with teak include upland rice (*Oryza sativa*), sesame (*Sesamum indicum*), maize (*Zea mays*) and vegetables. The village resource map of Taungya Village is presented as Fig. 4.

Taungya village is temporary in nature. Both the Township Forest Department and the taungya farmers intend to establish a permanent village so that taungya

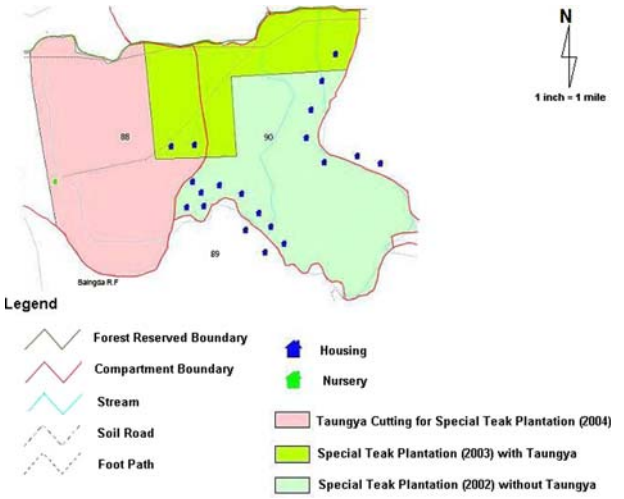

Fig. 4 Village resource map of Taungya Plantation Village

farmers can settle in one place. Discussions have been held between the forest officials and group leaders of the Bamar and the Karin since 2000. However, no final agreement has been reached because the Bamar want to settle in a lowland wetland area where they can engage in *paddy rice*[8] farming, whereas the Karin want to settle in an upland area because it is their tradition and they prefer to grow non-irrigated *upland rice*. The Township Forest Department wants both groups to settle in one place, mainly to secure the labour force.

Each of the three plantation villages was established mainly with the intention of obtaining labour for tree planting. However, the success of plantation villages depend solely on the will and motivation of local forest officials in each plantation zone and the degree of participation from the taungya farmers, since the Forest Department Headquarters does not take any responsibility relating to schools, healthcare services and other social amenities. Since there is no official aid, the local Forest Department and taungya farmers have to work on their own within the plantation budget.

Village Needs Assessment

In order to construct a wish list, plantation villagers were asked during interviews to indicate their highest priority for development of plantation villages. Responses were highly diverse and situation-dependent. Health care services for family members and schools to educate children were the highest ranked on the wish list. Establishing health care services and schools are the two major tasks that the Forest Department needs to accomplish to uplift the living standards of the plantation

[8] The word 'paddy' is derived from the Malay word pady, meaning rice. Paddy rice or 'rough rice' means that the whole grain has been taken off the plant at harvest. The white rice grain after milling and polishing makes up less than three-quarters of the weight of paddy rice.

villagers. Availability of funding for agricultural investment is the next highest priority, although this is a priority for only a small percentage of villagers.

There is a high level of inequality of services between plantation villages. Even though taungya farmers living in temporary villages have been working in the taungya teak plantations for several years, some of these villages do not have schools even for primary education nor the basic health care services. They have the poorest social welfare system due to their non-permanent and mobile state, hence the living standard is low.

Even in permanent villages, resource inputs are highly variable. Some have the opportunity to establish community forestry plantations, and some are given the right to cultivate traditional rice fields inside the reserved forests (such as the rice fields inside the teak plantations near Gontaung). In some villages, all the rice fields have been taken back, and then divided equally between the plantation villagers, as has been the case in Sanpya. For some villages (including Sanpya), primary schools have been established by the Township Forest Departments, but other are run on a self-help basis (including Taungya Village). Few villages have access to basic health care services (Sanpya).

Problems Facing Taungya Villages

In the early 1980s, supply of rice rather than daily cash wages had been used as one of the incentives for the establishment of plantation projects. However, after the advent of a market-oriented economy, rice distribution at a low price was terminated. This may be one of the reasons why lowland Bamar farmers abandoned taungya teak plantations in the late 1990s.

Local forest officials try to give villagers informal rights to cultivate rice fields in the wetland areas of reserved forests, but have limited authority to grant informal rights in these areas. Most taungya farmers do not own cattle or buffalo for ploughing. If they have to hire work animals, they have to pay the owner more than 1,000 kg of paddy rice for one crop season. The areas granted for cultivating rice are sometimes too small to cover both the payment and household consumption, and the rice insufficiency problem persists.

Access to fuelwood, though not a problem for temporary villages with continuing plantation projects, becomes a problem for left-over permanent villages surrounded by teak plantations. People in Gontaung have to undertake a three-day trip with bullock cart to gather firewood. Establishment of community forestry plantations should be considered and encouraged in these types of plantation projects, and may even allow the Forest Department to able to create buffer zones for the main teak plantations.

As stated in the Tharrawaddy Working Plan (Government of Burma 1946), education seems the only solution for the long-term development of the plantation villagers. At the very least, primary schools should be established to educate the next generation of taungya farmers. For temporary villages, even if it is difficult to establish schools, appointing teachers to educate the children warrants consideration. Health care services are a critical priority in plantation villages. Even though it is a formidable task, the local Forest Department should consider the possibility of

training the educated women in the plantation villages to become midwives or health workers.

Data Analysis for Exploring the Situation of Plantation Villagers

Principal components analysis has been used to explore the underlying structure that makes up the various socio-economic household groups, and to determine how many components are involved in identifying the typology of these groups.

In this study, the most commonly used approach, Varimax rotation of PCA (described by Pallant 2001) has been used as a factor extraction technique to identify the typology of the plantation villagers. Nineteen key variables have been used in data analysis. The selected variables can be classified into seven groups according to their related fields:

1. Variables relating to rice paddy V1, V2
2. Variables relating to taungya V3, V4, V5, V13
3. Variables relating to animal husbandry V6, V7, V8
4. Variables relating to household consumption V9, V10, V11
5. Variables relating to community forestry V12
6. Variables relating to income V14, V15, V16
7. Variables relating to expenditure V17, V18, V19

The analysis has been carried out using the software package XLSTAT. Kaiser's criterion, the Scree test and Parallel Analysis have been used to make decisions on retaining three factors out of six. In this research, the aim is to explore the socio-economic groups which implied the use of orthogonal rotation, hence Varimax rotation was performed to aid in the interpretation of these components. The loadings of each of the variables on the selected three factors are presented in Table 3.

The three-factor solution explains a total of 56.0% of the variance, with Component 1 contributing 23.32%, Component 2, 17.78%, and component 3, 14.90%. The first factor deals with variables relating to taungya, household consumption, community forestry, income and expenditure, which share the conceptual meaning of a promising living standard. The second factor has strong loadings only on variables relating to taungya, and explains the concept of sole dependency on the taungya teak plantations. The third factor can be interpreted as the dependency on paddy fields as the main farming activity. The highest loadings are on the harvested paddy and the paddy fields.

Score Plots Presenting the Typology of the Plantation Villagers

The two score plots were obtained by revealing the relation of the first factor with the second and third factors. The first observation reveals the relation of the first factor which shares the conceptual meaning of a promising living standard and the second factor which has a strong relation only with taungya. The second observation is to reveal the connection of a promising living standard with dependency on paddy

Table 3 Varimax rotation of three-factor solution

Variable	Component 1	Component 2	Component 3
V19: Total household expenditure	0.86		
V17: Kitchen expenses	0.85		
V12: Community forestry plantation (ha)	0.74		0.36
V16: Total net income of the household	0.64		
V15: Income from informal work	0.62		
V18: Medical expenses	0.54		
V5: Harvested agro crops (kg)	0.52	0.34	
V11: Monthly oil consumption (kg)	0.42		
V7: Harvest (cow, cattle, buffalo)			
V14: Net income from agricultural related activities		0.84	
V13: Taungya area for the year 2006 (ha)	0.36	0.75	
V8: Poultry		0.69	
V10: Monthly chicken consumption (kg)		0.67	
V3: Taungya area for the year 2005 (ha)	0.51	0.66	
V4: Harvested upland rice (kg)		0.61	−0.56
V2: Harvested paddy (kg)			0.89
V1: Paddy fields (ha)			0.88
V9: Monthly rice consumption (kg)	0.46		−0.49
V6: Cow, cattle, buffalo			0.45
Percentage of variance explained	23.32	17.78	14.90

Note: Only loadings above 0.3 are displayed

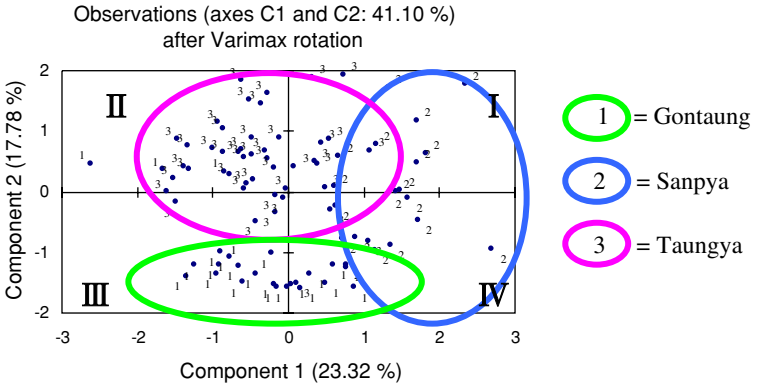

Fig. 5 Score plot of Component 1 and 2

fields. In the first score plot (Fig. 5), households from Sanpya and Taungya villages fall in the first quadrant which represents a promising living standard and participation in taungya work. Households from Taungya Village are found in the second quadrant, which still represents participation in taungya work but absence of a promising living standard. Households from Gontaung are found in the third

quadrant which has no relation with taungya nor a promising living standard. The fourth quadrant, which has no relation with taungya but has a promising living standard, comprises Gontaung and Sanpya households.

In the second score plot (Fig. 6), almost all the households from Sanpya fall in the first quadrant, having opportunities for rice farming and also a promising living standard. Households from Gontaung found in the second quadrant are those which have rice fields but not a promising living standard. In the third quadrant, which has no relation with rice fields nor a promising living standard, households from Gontaung and Taungya villages can be seen. Lastly, households from Taungya village which have promising living standard but no relation with rice fields can be found in the fourth quadrant.

In summary, 10 households, all from Sanpya, have positive loadings on all the three components which means they have taungya, paddy fields and all the income opportunities, which is an indication of a promising living standard. Another 10 households, all from Taungya village, are engaged in taungya farming and have a promising living standard, all having positive loadings on Component 1 and Component 2. Two households from Gontaung, nine households from Sanpya and 1 household from Taungya Village have higher loadings on Component 1 and Component 3, indicating a promising living standard with paddy fields as the major farming activity.

Data from 7 households, 3 from Gontaung and 4 from Taungya Village, reveal that even though they have paddy fields and are engaged in taungya farming, they do not have a promising living standard. Twenty-four households from Taungya village have positive loadings on Component 2 but negative loadings on Component 1, revealing that

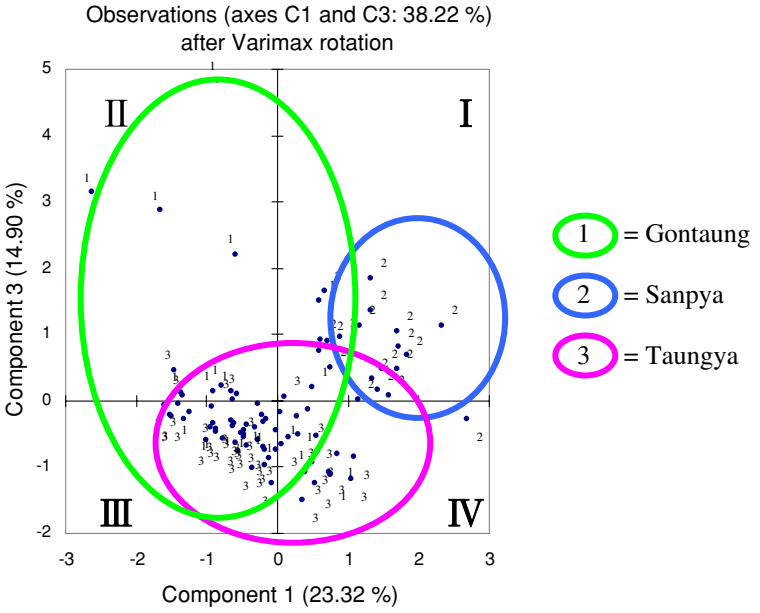

Fig. 6 Score plot of Components 1 and 3

even though they participate in taungya farming, they do not have a promising living standard. Five households from Gontaung have high loadings only on Component 3.

Fourteen households have no access to taungya or paddy fields and are without any prospect of a promising living standard. These include nine households from Gontaung and five from Taungya village. The remaining households have no access to taungya or paddy fields but have a promising living standard; these include five households from Gontaung, 1 from Sanpya and 2 from Taungya village.

Discussion

Forty of the 90 sample households have what can be described as a promising living standard. It seems that the plantation village system in Myanmar works well from a socio-economic point of view. From a one-dimensional view, the percentage of households with a promising living standard, 44.4% in total, seems impressive. However, closer examination reveals some problems. Among the households which have a satisfactory socio-economic situation, 50% are in Sanpya, 32.5% in Taungya Village, and the remainder in Gontaung. In terms of the social and environmental characteristic of the two villages, Sanpya village was only formed in 2005, and is thus well-resourced. These resources include nearby teak plantations for casual plantation work and taungya cultivation, paddy fields officially granted by the Forest Department to encourage their participation and access to forest resource use. Gontaung, which was formed in 1998, might once have had such opportunities; however, as it is now a permanent village, it has not had contact with teak plantation projects since 1999. It no longer has access to casual work in plantations or land for cultivating taungya, and has been facing difficulties in accessing forest resources because all the nearby forest areas have been transformed to teak plantations. Some of the villagers have attempted agricultural encroachment in teak plantation areas as well as illegal logging. These villagers are now, what the Forest Department would describe as a 'forest destructive group'. The main underlying factor is the socio-economic hardship caused by the lack of long-term development programs.

Households in Sanpya actively participate in taungya teak plantation establishment because at present they have the best socio-economic situation among the three villages. They might follow the same path as Gontaung once they begin to face economic hardships after the nearby plantation projects have been completed. Further, even though Component 1 generally represents a promising living standard, the highest loadings of Component 1 happen to be variables for expenditure rather than income. It can be inferred that the villagers from Sanpya who have the most promising living standard might still have some economic problems, and thus the above judgment—that socio-economic hardship is the main underlying factor—is supported.

Conclusion

A socio-economic survey carried out in three plantation zones in special teak plantation areas in the Bago Yoma exposed a change in the socio-economic pattern

of the plantation villagers during the eight-year period of the special teak plantation project. An analysis of these data provides insights into policies for redressing deforestation and creating forest protective groups.

The reason for the forest protective groups turning into destructive groups appears to be defects in the design of the taungya project. The Forest Department chose to establish plantation villages, not with the intention of improving the quality of community life, but to overcome difficulties in the establishment of large-scale plantation projects. Local people joined the project not because they are aware of the vital role of the forests in the well-being and socio-economic development of the nation, but because they needed land to cultivate taungya for survival.

Data analysis to explore the socio-economic situations of the plantation villagers clearly reveals that permanent plantation villagers have the best prospects of a promising living standard at the initial stage. However, as the incentives for permanent villagers are temporary with no long-term consideration for their sustainable socio-economic development, permanent villagers have to face the worst socio-economic hardships after the end of the nearby plantation project. For temporary villagers, they are also in a highly vulnerable situation from a social welfare point of view. The families of the temporary villagers face difficulties in accessing health care services and their children do not have the opportunity to attend even a primary school.

It can be concluded that permanent plantation villagers are more likely to become forest destructive groups than are temporary villagers. Destruction of teak plantations, agricultural encroachment and even illegal logging can mostly be seen in the permanent villages. This destruction takes place because the villagers are surrounded by untouchable teak plantations without any formal access to resources on which to survive. This reflects the observation of Davies and Wismer (2007), who pointed out that 'When government policy restricts access to resources that local people require on a daily basis, … even well-funded coercive conservation generally fails'.

This finding does not necessarily mean that permanent villages should not be established, and in fact they are critical to the quality of community life. However, it must be recognized that the sustainable socio-economic development of the plantation villagers is the key for the success of redressing deforestation through people participation.

Policy Implications

Many researchers criticize the top-down forest management in Myanmar and encourage a transformation to decentralization, benefit sharing, and a bottom-up management approach with citizen's participation in plantation establishment. However, there are a number of reasons why such a policy change may not succeed. First, it may be difficult to change Article 8.A of the *Myanmar Forest Law* (Govt. 1992) which explicitly stipulates that 'a standing teak tree wherever situated in the state is owned by the state'. Second, even if the above statement could be revised with high financial incentives from tree planting, only large organizations could

replace the Forest Department in taungya teak plantation development. The lives of the local people may remain unchanged because it is difficult for them to secure a place in this profitable but long-term enterprise.

At present, the Myanmar Forest Department is the only enterprise, and taungya farmers are the main participants, in taungya teak plantation projects. Instead of criticizing the centralized management, consideration should be given to what changes might be possible under the present situation and to what extent these changes would benefit local communities.

For establishing permanent plantation villages, it would be beneficial to identify areas for special teak plantations, for at least a 5-year project. The village could be established in the middle of a planned 5–year project area so that the plantation villagers would have a secure income for at least five years. The village should be established on a manageable scale in terms of sharing the resources among the villagers and the feasibility for the Forest Department (2000) to grant land allocation to the villagers for agroforestry practice. In conformity with Act 15 of the *Forest Law* (Govt. 1992), which allows use rights in village-owned fuelwood plantations, and *Community Forestry Instructions*, which permit agroforestry practice in allotted land, the plantation villagers should be given the right to establish a community forestry plantation of 1.2 ha per households in the initial year of 5-year plantation projects.

During the 5-year period, a sound landscape system could be introduced which ensures sustained income from agroforestry practices. As suggested by Keh (2000), the landscape system should be arranged to include much greater space for initial agricultural products and fruit trees for income generation, with multipurpose trees and also soil improving trees and plants included in the system. At the same time, the establishment of home gardens should be encouraged. In this way, permanent villagers will be able to continue independently when teak planting is completed after five years.

It would be beneficial if income-generating groups could be formed with financial assistance from the government or in cooperation with donor organizations. The aim is to create self-help management groups which can manage their own finance in the best interests of their own community with the participation and guidance of township forest officials. It is further suggested that this finance be circulated within the community at low interest rates and the money received through interest payments be used for education, health care and social amenities.

Where it is not possible to ensure sustainable development for permanent villages, such villages should not be established, because the villagers will through necessity eventually become forest destructive groups. In this situation, the custom of a temporary village system would be a wise choice. However, it is critical to arrange a basic social welfare system for temporary villages. The Forest Department itself or in cooperation with other organizations, could appoint teachers to educate the children and some of the prospective local villagers could be trained to become midwives and health workers for the taungya families.

Finally, it is necessary to respect the social and cultural difference of the ethnic groups, and not force uplanders to move to the lowland or lowlanders to the uplands by creating these permanent villages, nor should they be forced to live together in one place. The plantation village system will be successful if, and only if, it is

created as an acceptable environment for the participants. In this way, forest protective groups can be created.

Planned Further Research

For research relating to reformation of the plantation village system and associated policies, companion modelling is the well-accepted approach (Gurung et al. 2006). In this project, further research is planned to create a sound model of plantation village and to identify necessary policy reforms with the participation and agreement of all the interest groups. For this research, the interest groups should include academic professionals, administrative officials and rural indigenous groups. It is planned to interview members of these groups to obtain their opinions on the following four points, which were developed from the exploratory research on the socio-economic situation of plantation villagers:

1. Establishing a village in the middle of a 5-year teak plantation project area so that the plantation villagers can have a secure income for at least five years.
2. Giving concession rights to the plantation villagers for establishing community forestry plantations.
3. Introducing a sound landscape system that can ensure sustained income from agroforestry practices.
4. Forming income generation groups.

Further research will begin with interviewing academic professionals to obtain their views about the suggested policy implications. Administrative officials will then be interviewed to determine whether the suggested plan is acceptable from the point of policy-makers. A draft model of a plantation village will then be developed, and will be discussed with the rural indigenous groups. If the plan is acceptable, the model will be ready for application. If not, the needs of the rural indigenous groups will be discussed again. While this will be a limited application of companion modelling, it is anticipated that a realistic model of plantation village can be designed, supported by all the interest groups—in other words, having acceptable social, economic and environmental characteristics.

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